EFFICACY OF USE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SERVICES ON AGRICULTURAL PRODUCTIVITY

Synopsis

Submitted in the partial fulfilment for the requirement of

Doctor of Philosophy

In

Applied Business Economics

Submitted By

Deepika Yadav

Under the supervision of

Prof. Shalini Dubey

Dept. of Applied Business Economics

Dept. of Applied Business Economics, Faculty of Commerce
Dayalbagh Educational Institute (Deemed To Be University)
Dayalbagh Agra -282005
2022

INTRODUCTION

ICT can be interpreted broadly as "Technologies that facilitate communication and the processing and transmission of information by electronic means." ICT promises a fundamental change in all aspects of our lives, including knowledge dissemination, social interaction, economic and business practices, political engagement, media, education, health, leisure and entertainment. "Information Communication Technology" concentrates on these three words: Information, Communication and Technology; to promote information via communication with the help of technology.

In India around 70% of population earns its livelihood from agriculture. According to census 2011, 68.9 percent (83.3 Crore) population is still rural. The agriculture sectors more than half the output of the Indian economy. Rural sector plays an important role in Indian economy, because most of the raw material for industrial sector as well as agricultural and food grains product are arising from rural sector. However, the application of ICT in the agriculture sector has been relatively slow. The main reasons for this are poor ICT infrastructure in rural areas, poor ICT awareness among agency officials working in rural areas and local language issues.

In the past few decades, information and communication technology (ICT) has transformed the world. It's potential for reducing poverty and fostering growth in developing countries has increased rapidly. Mobile telephones provide market links for farmers and entrepreneurs. The Internet delivers vital knowledge to schools and hospitals. ICT has played a vital role in national, regional and global development, and holds enormous promise for the future.

Nowadays, more and more new advanced technologies are used for agricultural development, such as satellites, the Internet, mobile phone and social media. The use of the technologies and divides in both developed and developing nations can be used to improve agricultural information and farming methods with transformational development. ICTs have been found to increase productivity and output, reduce cost of transportation and many other benefits. The large business investment must be done in the agriculture, animal husbandry, etc. The study focuses on the need of ICT for agriculture development. Implementing ICT involves a lot of things. First, to interact with people, establishing the network and so on. The strategies can be changed by using ICT as using it by connecting to the experts in the European countries and taking guidance of them to improve the current situation.

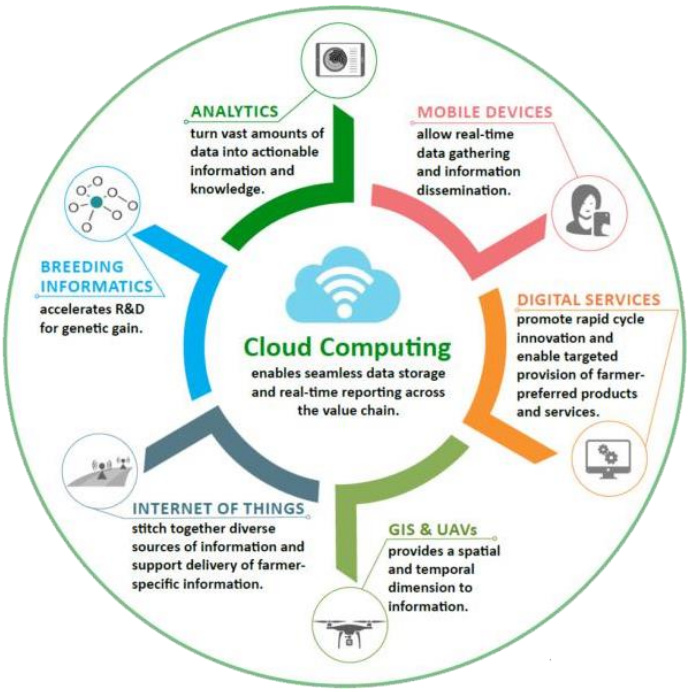
ANALYTICS
turn vast amounts of data into actionable information and knowledge.
MOBILE DEVICES
allow real-time data gathering and information dissemination.
BREEDING INFORMATICS
accelerates R&D for genetic gain.
Cloud Computing
enables seamless data storage and real-time reporting across the value chain.
DIGITAL SERVICES
promote rapid cycle innovation and enable targeted provision of farmer-preferred products and services.
INTERNET OF THINGS
stitch together diverse sources of information and support delivery of farmer-specific information.
GIS & UAVs
provides a spatial and temporal dimension to information.

Fig-1 Technology Adaption
(Source: https://www.pngwing.com/en/free-png-micsiz)

ROLE OF ICT

There are many aspects in which ICT can be effectively used such as education, economic development, employment opportunities, e-governance, capacity building and employment, agriculture and many more.

ICT for Education:

ICTs in the classroom fosters critical, integrative and contextual teaching and learning; develops information literacy (the ability to locate, evaluate and use information). Thus, it improves the overall efficiency of the delivery of education in schools and educational management institutions at the national, state/provincial and community level. The use of ICTs in education aims to improve the quality of teaching and learning as well as democratize the access to education.

ICT for Economic Development:

Information and Communication Technology has a vital role in connecting the rural community to outside world for exchange of information, a basic necessity for economic development. Effective use of ICT can demolish geographical boundaries and can bring rural communities closer to global economic systems and be of meaningful help to the underprivileged.

ICT for Employment Opportunities:

Poor people in rural localities have lack of opportunities for employment because they often do not have access to information about them. One use of ICTs is to provide on-line services for job placement through electronic labour exchanges in public employment service or other placement agencies.

ICT in e-Governance:

The poverty can be adequately addressed by effective use of e-governance and ICT application in environmental management. Improved governance by using ICT can have direct impact in reducing poverty and improving the environment. ICT can contribute in a large way in making government processes more efficient and transparent by encouraging communication and information sharing among rural and marginalized people.

ICT in Capacity-building and empowerment

Communities and farmer organisations can be helped through the use of ICTs to strengthen their own capacities and better represent their constituencies when negotiating input and output prices, land claims, resource rights and infrastructure projects. It widens the perspective of local communities in terms of national or global developments, opens up new business opportunities and allows easier contact with friends and relatives.

ICT in Agriculture:

Information and communication technology in agriculture (ICT in agriculture), also known as e-agriculture, focus on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture.

- **Financing:** Agriculture finance has a vast scope in future. Agriculture Rural Multipurpose Development Banks in India have become important institution providing long-term agriculture credit. The involvement of the NABARD in financing long-term agricultural credit has necessitated the need for the effective functioning of the agriculture in India.

- **Marketing:** Agriculture marketing play an important role not only in stimulating production and consumption, but in accelerating the pace of economic development. Its dynamic functions are of primary importance in promoting economic development. Agriculture marketing is concerned with the marketing of farm products produced by farmers and of farm inputs required by them in the production of these farm products.
- **Insurance:** The use of technology in insurance improves every aspect of an agency's data management system and processes. Insurance agents can quickly respond to the needs of customers, using state-of-the-art technology that can instantly provide accurate information to clients regarding insurance issues. Insurance technology eliminates a great deal of paper handling and travel cost once required by Insurance agencies.
- **Production:** ICTs can facilitate access to timely and accurate information for an improved agricultural production. Access to information is crucial in family farming, which is known to be heterogeneous, primarily-based labour, production of highly diversified products and limited access to productive resources. Through ICT, farmers can be updated with the recent information about agriculture, weather, new varieties of crops and new ways to increase production and quality control.

ICT in Agricultural Productivity

Agriculture Productivity is measured as the ratio of Agriculture outputs to inputs. while individual products are usually measured by weight, which is known as crop yield, varying products make measuring overall agricultural output difficult.

- Agricultural data, information and knowledge generated by the farmers themselves by interacting with fellow farmers influence agricultural productivity in various ways. It can help farmers take the right decision about the land, labour, variety, fertilizer, capital and management.
- The ICT have shown evidence for easier access to agricultural development to the standard livelihood of farmers.
- The computers, internet, geographical information systems, mobile phones, as well as traditional media such as radio or TV stimulate participation and enhance the value of productivity.

- Technology composed of ICTS are the blessing to agriculture as they provide the farmers with data, information and knowledge with which they can empower themselves with modern agricultural technology and act accordingly for increasing the production of higher value crops, reduction in expenses of production, increase in selling price, less use of pesticides for vegetables on their farms.
- The use of ICT has become increasingly integrated to address the farmers information need in all over the world, the ICT have transferred most important information about agriculture in developing countries.

REVIEW OF LITERATURE

TABLE-1 NATIONAL REVIEWS

S. No	Author	Paper Title and Year	Objectives	Research Methodology	Findings
1.	Bhusanar Shatrughn Bhagawan and Singh Ramandeep	"Role of ICT in agriculture sector", 2019	1) To study ICT Initiatives for Agricultural in India. 2) To study the major components used and framework of ICT in Agriculture.	This study is based on descriptive analysis.	This study concluded that ICT projects are yet to make any development in agricultural information spread and other areas. It is essential of hour to obtain apposite information through ICTs and to expand advanced ICTs in agriculture.
2.	Bikash Narayan Naik and Suman Mishra	"Emerging role of ICT in Indian agriculture", 2018	This paper analyses the dynamics of digital transformation of the Indian agricultural system and major drivers of transformation, giving an overview of the past achievements and the future challenges in Indian agriculture.	This study is based on explanatory research.	The study outlined the critical roles of ICT in agricultural technology development in India centring on opportunities and challenges. This review has identified that agricultural research, improvement of market activity, exchange of relevant information, networking agricultural activities globally etc. However, lack of basic ICT skills, absence of political will, in adequate and fluctuation of power supply, poor internet infrastructure etc.
3.	1.Puspendra Kumar Singh 2. Rupasi Tiwari 3. Triveni Dutt	"Adoption of ICT among the Farmers of Different Agro Climatic Zones of Uttar Pradesh" ,2018	To identify the adoption level of the different information communication technologies among the farmers and different factors affecting it.	ICT adoption among the farmers was measured through ICT adoption index which is weighted mean of indices for three indicators viz., possession of ICT tools, accessibility of ICT tools and ICT. utilization competencies among the farmers. Total 12 equiweighted items were considered under these	The results revealed that education, annual income and message utilization index were having highly significant and positive relation with ICT adoption among the farmers. Higher adoption ICT tools can also lead to a synergistic effect on the utilization of mKisan services leading to better agricultural production and productivity in the state.

				three indicators for estimation of ICT adoption.	
4.	1.Keshari Nandan Tiwari, 2.Dr. CB Dubey	"Impact of information technology in rural development: An analytical study in Allahabad District", 2017	1) To identify the importance of Information technology is to helpful in the growth of agriculture. 2) To know the impact of information technology in the development of rural activities. 3) To identify the level of usage of technology in rural areas.	This paper is based on a questionnaire-based survey of the rural people in the villages of Allahabad District. The collected data analysed by Chi -square statistical method.	This study shows that the priority need of the information technology is essential to all rural people for our basic growth and development. The coaching and such type of training centre should be opened by the government, which can grow the importance of information technology as well as technological equipment in rural sector.
5.	Neelesh Pandey	**"**Role of information and communication technology in agriculture development: A study of Nab Rangpur district", 2017	1)To find out the ICTs application in agriculture in Raighar block. 2) To find out role of ICTs in agriculture development. 3) To assess the people's awareness towards ICTs application in agriculture development.	Primary data has been collected through questionnaire and survey and Secondary data has been collected through: National and state government agriculture portal, Policy and act of Orissa Government. Data are analysed in qualitative and quantitative methods. To test the quantity of data SPSS software has been used.	This study shows that among the media users, around 38% know about the DD Kisan Channel. Those are known about the DD Kisan Channel 63.63% percent are watching the channel regularly, among them 97.5% said that all the contents are relevant for agriculture extension. Climate info play crucial role for the cultivation. Here at Raighar an average 12.50% of farmers" using ICTs application to know about climate/weather info.
6.	Sunita	"ICT in Rural Development of India", 2017	Positive and negative impact of ICT in rural areas challenges of application of ICT in rural development.	This study was conducted with the help of secondary data like books, magazines, research paper, journals, articles, official records and	This study concluded that Information Technology indirectly impacted the rural economy and helping in rural development which is major issue for developing countries like India. Analyses show that

				other existing sources of data.	effective applications and channels have been used to benefit rural economy.
7.	Dr. S.S. Gautam and Ankita Gupta	"ICT for Rural Development: Opportunities and Challenges" 2017	To find out these applications use the ICT in present for better and reasonable connectivity and processing solutions.	This study is based on secondary data.	This study concluded that 81% citizens report reduction n in corruption, 95% find cost of e-governance affordable and 78% favour's fast of delivery of services. Therefore, we can say that e-Governance is the explanation to the "Good Governance" for the developing country India to minimize corruption provides efficient and effective services to their citizens.
8.	Surabhi Singh, Santosh Ahlawat and Sarita sanwal	"Role of ICT in Agriculture: Policy implications", 2017	1)ICT Initiatives for Agricultural in India. 2)Major components used for ICT initiatives in India.	This study was conducted with the help of secondary data.	ICT projects are yet to make any breakthrough in agricultural information dissemination and other areas. Deployment of ICTs needs to be stressed more. ICT for agricultural projects needs to be compared and evaluated precisely. It is need of hour to obtain apposite information through ICTs and to deploy advanced ICTs in agriculture.
9.	Dr. Sangita Agrawal	"Role of ICT in rural development of India", 2016	1)To find out the role of ICT in solving the problems of rural economy in India. 2)To analyse and examine the impact of this technology on rural infrastructure growth and development.	This research paper is carried out with the help of only secondary data collected from different sources like books, magazines, research paper, journals, articles, official records and other existing sources of data.	Analyses have showed that effective applications and channels have been used to benefits the rural economy. However, it is essential that the govt. should take more initiative to increase the use of this technology in its development programmes.
10.	1.Tauffiqu Ahamad, 2.Jitendra Kumar Pandey	"A Study on Application and Role of ICT in Rural Development" ,2014	1.To analyse the role and scope of ICTs in rural development. 2. To suggest course of actions that should be	1.This research paper is based on secondary data like Science Direct, Google Scholar, Emerald, and SSRN. Some information is	In the conclusion of this study, Technological advances in ICTs have reduced the cost and increased the quantity and speed of information transfer dramatically. ICT in rural areas is the

			taken so as to utilise ICTs in better way for rural development. 3. To examine the current status of ICT in India.	also added from Internet search engine Google, and website like Ministry of rural development of Government of India and department of IT.	solution for gradual elimination of traditional barriers for development by increasing access to information, expanding their markets, increasing job opportunities and better access to the governmental services. As per observation it is found that awareness and information about the facilities and schemes is main cause of backwardness of rural areas.

TABLE-2 INTERNATIONAL REVIEWS

S. No	Author	Paper Title and Year	Objectives	Research Methodology	Findings
1.	Jeremiah Ejemeyovwi	"Can ICT Adoption Aid Crop Production in Nigeria? (Smart-Agriculture)", 2017	1)To identify the impact of mobile cell phones on agricultural output in Nigeria. 2)To determine the impact of Internet usage on crop production in Nigeria. 3)To know the degree of association between ICT adoption and crop production in Nigeria.	The methodologies used for this research are the Pairwise Correlation method and the Ordinary Least Squares (OLS) to determine the degree of association existing between the two variables involved in the research and to determine the short run relationship between the variables of interest respectively Gujarati. The data used for this research is secondary time-series data for Nigeria (1985 – 2014; 30 years).	This study show that Wide ICT adoption leads to improved value chain interaction, financial inclusion, increased research and development for increased productivity, governments and private investors should invest more in capital infrastructure such as ICT with focus on the agricultural sector for improvement to enable the use of ICT tools such as mobile applications, real time connection for sharing information for the development of the agriculture sector.
2.	Joyous S. Tata and Paul E. McNamara	"Social Factors That Influence Use of ICT in Agricultural Extension in Southern Africa", 2016	1)To identify and categorize the challenges hindering extension agents from the effective use of farm book	Data were collected through the use of a structured questionnaire. Data were analysed using both descriptive statistics	Our finding shows that extension officers with advanced degrees faced less technical challenges using Farm book than their less-educated colleagues. This finding underscores the need for

			2)To understand the relationship between selected national development indicators and the effective use of farm book by extension agents. 3)To understand the relationship between socio-economic status of extension agents and the challenges faced in using farm book.	and multivariate techniques using JMP 10 statistical software.	professional development and capacity building of officers lacking advance. A second finding from our analyses worth flagging up is that survey participants with Internet access in the field.
3.	Didarul Islam Manik, Charles A. Lubbers	"Use of ICT and traditional Agriculture information sources by Bangladeshi farmers", 2016	The main aim of this study is to investigate the usage of online agricultural information sources by farmers in Bangladesh. Additional objectives included investigating and describing the uses of different online portals by farmers.	Survey and in-depth interview data collection methods were used in this research. For quantitative data, a survey questionnaire was used to gather information from the respondents (farmers).	Farmers reported that main sources of their agricultural information are radio, television, agricultural extension officers, local markets, local opinion leaders and their fellow farmers. The research found that the farmers cannot use agricultural messages given to them by the agriculture service providers due to a lack of education, which hinders the development of agricultural practices.
4.	Oladele, O. I.	"Effect of ICT on agricultural information access among extension officers in north west province south Africa" ,2015	1)To Identify personal characteristics of extension officers. 2)To Examine the effect of Information Communication Technology on agricultural information access	A simple random sampling technique was used to select 169 extension officers from which data were collected. A structured questionnaire was designed. Data were analysed with Statistical Package for Social Sciences (SPSS) using frequencies, percentages, mean and multiple regressions.	The study has highlighted that extension officers in North West Province of South Africa were prominently male, with a mean age of 44.6 years married, with Diploma as educational qualification, had a mean household size of 5 persons and mean working experience of 16.7 years and live in their job location.

5.	Khondokar Humayun Kabir	"Attitude and Level of Knowledge of Farmers on ICT based Farming" 2015	This study focuses on the attitude and level of knowledge of farmers towards Information and Communication Technology as a source of information use in extension service delivery in some selected places of Mymensingh sadar Upazila, Bangladesh.	Validated interview schedule was used for data collection and appropriate statistical tools were used to analyse the collected data. Simple random sampling technique was used in the selection of ninety (90) farmers as the sample of the study.	The study revealed that the average age of the farmers in the study areas is 33.31 and most of the respondents were young aged. This established that farmers are still in their active years and can still cope with the different ICT tools. Based on the results obtained it can be concluded that farmers of the study areas have a moderately favourable attitude and the most important finding is that there are no farmers in the study areas who less or slightly favourable attitude towards ICT based farming.
6.	Aminat Showole, Bisallah Hashim	"Effect of ICT On Agricultural Sector in Nigeria", Academia Arena 2014	To determining the influence of information communication technologies in dissemination of information to urban farmers.	Primary data for the study was obtained by random sampling of 60 respondents from agricultural companies in Imo state, Abia state and FCT, Abuja. Descriptive statistics such as mean and frequency table for data analysis were used and questionnaires also administered to the farmers. Secondary data were obtained from published documents and records.	From observations, it was revealed that many agricultural researchers owned a laptop and browse by wireless networks. Furthermore, cybercafés were located in many schools of agriculture and offices to create Internet access for researchers which is supplemented by private cybercafés located close to their offices and within reach. Findings through the research questionnaire showed that all ICT facilities named in this study were used for agricultural research.
7.	Hopestone Keyiska Chavula	"Role of ICT in Agriculture Production in Africa",2013	This study aimed to determine the impact of ICTs on agriculture output growth in Africa.	Researcher assume a Cobb-Douglas agricultural production function with A being the Hicks-neutral productivity level which is dependent on ICTs and level of education and E being an	The empirical analysis results suggest that ICTs play a significant role in enhancing agricultural production, and the use of telephone main lines remains a significant contributor to agricultural growth despite the wide proliferation of mobile phones.

				identical and independently distributed random variable.	
8.	Farhad Lashgarara, Roya Mohammadi and Maryam Omidi Najafabadi	"ICT Capabilities in Improving Marketing of Agricultural Productions of Garmsar Township, Iran", Annals of Biological Research, 2011	This study is aimed to identify ICT capabilities in marketing the agricultural products of Garmsar city in 2011.	This is an applied study. The analysis used in this study involved a combination of descriptive and quantitative research and the main methodology is descriptive (non-experimental) and correlation, after data extraction, statistical analysis was done by SPSS version 16.	This study showed that the situation of Garmsar marketing is fairly desirable. ICT have a moderate role in improving agricultural products marketing. Improving in agricultural marketing in Gramsar township is mainly pertained to new methods of agricultural products advertising (e.g. advertising via email and mobile phone), delivering information about selling of products, improving prices of agricultural product, increasing yield of agricultural products, etc.
9.	Hassan, Abubakhar & Obidi	"Impact of Information and Communication Technology on Agricultural output" 2011	This study aimed to determine the impact of ICTs on agriculture output growth in Iran.	Data were collected through the use of a structured questionnaire.	Empirical evidence shows that ICT has a positive impact on agricultural output. Most of the works used primary data which involves the use of questionnaires for data collection. ICT has been proven to be the engine of growth in the 21st century.
10.	Munyua	"information and communication technologies are a key input for economic development and growth"2008	This study aimed to describe the role of women and men in agricultural and rural development in Africa.	This study is based on Primary data.	This study shows that Information and knowledge play a central role in rural agricultural development. In describing the role of women and men in agricultural and rural development, information and knowledge are essential if women and men are to respond to opportunities and major challenges of the coming century. In emphasizing the role of information and knowledge, information and knowledge is described as prime productive resources.

GAPS OF THE STUDY

- After studying the reviews in this area, the researcher has found that majority of studies have been done in the area of general role of ICT in Agriculture but not specifically about the ICT and its relation with Agriculture Productivity.
- In addition to the above the researcher could not found any study on demographic basis in the selected area.
- Agra Division needs one organised model in Agriculture area based on Challenges faced by farmers in use of ICT, regarding this also no study has been carried out in the past.

NEED OF THE STUDY

The review of past studies describe that ICTs have made a valuable contribution for solving development related issues and difficulties of society and accomplish successful task in various sectors like tourism, education, agriculture, financial services, manufacturing, healthcare and many more in rural and urban areas of India and hence ICT becomes a very important tool of all human aspects of life. Reviews mainly focus on implications of Information and Communication Technology and its Tools on rural society as well as application of ICT in Agriculture sector and related aspects.

SCOPE OF THE STUDY

Reviews of the past study describe that ICT has proved itself a game changer for solving the basic problems of agriculture sector by facilitating farmers and KVKs in various means. Use of ICT brings a lot of change in the way of- (1) solving the problems of rural areas and (2) Framing policy by the government. Now a days, government is facilitating farmers by providing ICT means in every aspect of agriculture like financing, marketing, production and insurance, etc. So, this is the high time to do research in this area to know its impact and problems in agriculture. Agra Division has been taken as the scope of the study.

OBJECTIVES OF THE STUDY

The main objectives of the present study can be figured out as follows:

1. To get an overview of the role of ICT Services in Agriculture sector.
2. To determine the awareness level of farmers and its effect on the use of ICT initiatives in the selected area on demographic basis.

3. To know the impact of ICT services on Agriculture Productivity on major crops of Agra Division.
4. To construct an action plan based on the use of ICT services in Agriculture and challenges faced by farmers.

HYPOTHESES OF THE STUDY

The following hypotheses will be tested in the proposed study.

- H_{01}: There is no awareness of ICT amongst farmers of Agra Division.
- $H_{02:}$ There is no effect of ICT initiatives on farmers of Agra Division.
- $H_{03:}$ There is no significant impact of ICT services on Agriculture Productivity on major crops of Agra Division.

RESEARCH METHODOLOGY

TABLE-3 RESEARCH DESIGN ADOPTED

S. No.	Parameters	Description
1.	Research Design	Descriptive Study
2.	Sampling Method	Probability Sampling Method
3.	Sample size	598 Respondents
4.	Sample Element	Respondents (Farmers & KVKs Staff)
5.	Sample Area	Agra Division
6.	Sample Unit	04 Districts (Agra, Firozabad, Mainpuri, Mathura)
7.	Research Approach	Websites, Books, Journals, Thesis, Newspaper, Published records etc.
8.	Research Instrument and Contact Method	Questionnaires or schedule filled through personal visit to farmers and interview with KVKs Staff.
9.	Data Collection	Primary and Secondary data
10.	Data Analysis	Descriptive & Inferential statistics

DURATION OF THE STUDY

A period of the recent 5 years (i.e., 2016 to 2021) will be taken into consideration for the study purpose.

VARIABLES OF THE STUDY

The following figure 1.1 shows the Independent and Dependent variables included in the study.

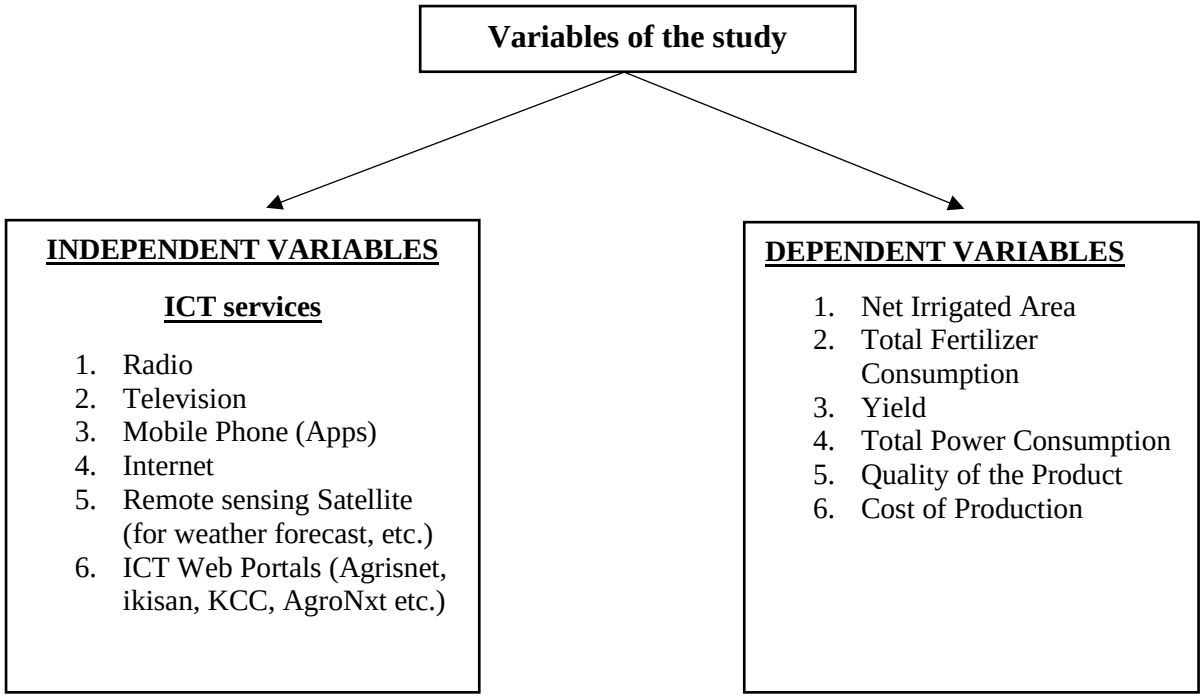

Figure- 2 Variables of the study

TABLE-3 DESCRIPTIONS OF THE VARIABLES

S.no	ICT Tools	ICT Services
1.	**Radio**	Kisan Vani and All India Radio
2.	**Television**	DD Kisan Channel and Farm TV Channel
3.	**Mobile Phone Apps**	Agri app, IFFCO Kisan app, Agri media, RML Farmer, Kisan Yojana, etc.
4.	**Internet**	Agriculture related sites www.indiaagronet.com , www.agriculture.up.nic.in , www.farmech.dac.gov.in , etc.
5.	**Remote sensing Satellite**	Resourcesat-2 & Resourcesat-2A, Cartosat-1, RISAT-1, Kalpana-1, INSAT-3D & INSAT-3DR
6.	**ICT Web Portals**	iKisan, eSagu, IKSL, eArik, SMS Portal/mKisan Portal, Agrisnet, KCC, AgroNxt, Digital Green, Warana, etc

Selection of the Crops

Uttar Pradesh has a major share in the Agricultural sector of India. It has a large share in the Production of food grains. Western UP is the most agricultural progressive region in the state. Major crops like **Potato, Wheat, Barley, Paddy, Bajra, Maize, Mustard, Gram, Masoor**, etc have been found in the Agra Division. Out of these crops the researcher has selected these crops like **Potato, Wheat, Paddy** and **Barley** on the bases of **high productivity** in the selected districts (**Agra, Firozabad, Mainpuri** and **Mathura**) of **Agra Division** have present in Table-4 given below.

TABLE-4 DISTRICT-WISE MAJOR CROPS IN AGRA DIVISION

S.No.	Districts	Major crops in general	Selected Major Crops (with high Productivity)
1	Agra	Potato, Wheat, Barley, Paddy, Bajra, Pea, Maize, Gram, etc.	Potato, Wheat, Paddy and Barley
2	Firozabad	Potato, Wheat, Barley, Maize, Paddy, Bajra, Garlic, Masoor, etc.	Potato, Wheat, Paddy and Barley
3	Mainpuri	Potato, Wheat, Barley, Paddy, Maize, Mustard, Bajra, etc.	Potato, Wheat, Paddy and Barley
4	Mathura	Wheat, Barley, Bajra, Paddy, Potato, Maize, Mustard, etc.	Potato, Wheat, Paddy and Barley

(Source: agra.kvk4.in, Mathura.kvk4.in, Firozabad.kvk4.in and mainpuri.kvk4.in)

Selection of Division

The study will be conducted purposively in the selected state Uttar Pradesh (UP) as it is the largest state of India in terms of population and number of Krishi Vigyan Kendra. There are 75 districts, 86 KVKs and 18 Divisions in UP.

There are 18 Divisions in UP, the researcher has selected those divisions which have above 70% high literacy rate and have more production in agricultural sector. Out of 07 divisions, Agra Division has been selected randomly on the basis of Convenience Sampling. Agra division have four districts i.e. Agra, Firozabad, Mainpuri and Mathura. It has large number of KVKs (04) and high literacy rate. Shown in the table 5 given below.

TABLE-5 SELECTION OF DIVISION

Total Divisions in UP (18)	Division (Above 70% literacy rate/ high production)	Selected Division
Agra, Aligarh, Ayodhya, Azamgarh, Bareilly, Basti, Chitrakoot, Devipatan, Gorakhpur, Jhansi, Kanpur, Lucknow, Meerut, Mirzapur, Moradabad, Prayagraj, Saharanpur and Varanasi.	Agra, Azamgarh, Gorakhpur, Varanasi, Kanpur, Meerut and Prayagraj	Agra Division (Agra, Firozabad, Mainpuri and Mathura)

(Source: District wise development indicators Uttar Pradesh 2020 Report, updes.up.nic.in)

TABLE-6 BRIEF CLASSIFICATION OF DISTRICTS IN AGRA DIVISION

S.No.	Bases	Agra	Firozabad	Mainpuri	Mathura
1.	Blocks	15	09	09	10
2.	Tehsils	06	05	06	04
3.	KVKs	01	01	01	01
4.	Total no. of Villages	929	807	869	874
5.	Total Population	44,18,797	24,98,156	18,68,529	25,47,184
6.	Farmers	5,19,926	3,34,816	4,08,062	4,15,134
7.	Percentage of farmers	11.76%	13.40%	21.83%	16.29%

(Source: Censusindia.gov.in)

- **SAMPLE DETAILS**

Selection of KVKs staff as Respondents

All the Programme Coordinator (PC), Subject Matter Specialist (SMS), Programme Assistant, Farm Manager, Computer Programmer, Stenographer, Accountant of the selected 04 KVKs (Mathura-1, Agra-1, Firozabad-1, Mainpuri-1) formed the respondents of this study. There are 01 PCs, 06 SMS, 01 Programme Assistant, 01 Farm manager, 01 Computer Programmer, 01 Stenographer and 01 Accountant working in each district of selected KVKs. Thus, a total of 48 KVK staff has been selected as respondents mention in table-7 given below.

TABLE-7 SELECTION OF KVKS STAFF AS RESPONDENTS

S. No.	Staff members	KVK Agra	KVK Firozabad	KVK Mainpuri	KVK Mathura
1.	Programme Coordinator	01	01	01	01
2.	Sub. Matter Specialist	06	06	06	06
3.	Programme Assistant	01	01	01	01
4.	Farm Manager	01	01	01	01
5.	Computer Programmer	01	01	01	01
6.	Stenographer	01	01	01	01
7.	Accountant	01	01	01	01
	Total	**12**	**12**	**12**	**12**

(Source: agra.kvk4.in, Mathura.kvk4.in, Firozabad.kvk4.in and mainpuri.kvk4.in)

Selection of Farmers as Respondents

During preliminary visit to the selected 4 KVKs data related to number of registered farmers with KVK and how many of them have been using ICT initiatives. Researcher has decided to select 10% of farmers from each KVK who are using ICT initiatives. Thus, a total of 550 farmers are selected as respondents using proportionate to the size random sampling technique. A brief account of registered farmers, farmers using ICT initiatives and selected farmers from 4 selected KVKs is given below in table 8.

TABLE-8 SELECTION OF FARMERS AS RESPONDENTS

Name of KVK	No. of registered farmers	No. of farmers using ICT Initiatives	10% of selected farmers
KVK Agra	30000	2300	230
KVK Firozabad	15000	1000	100
KVK Mainpuri	25000	1200	120
KVK Mathura	25000	1000	100
Total	**95000**	**5500**	**550**

(Source: own survey of researcher in feb, 2021)

Researcher selected the total number of 550 farmers and 48 KVKs staff members as respondents. So, the total number of respondents is 598. Table 9 represents total number of respondents of the study given below.

TABLE-9 TOTAL NUMBER OF RESPONDENTS

S. No.	Districts	Farmers	KVKs Staff	Total
1.	Agra	230	12	242
2.	Firozabad	100	12	112
3.	Mainpuri	120	12	132
4.	Mathura	100	12	112
	Total	**550**	**48**	**598**

(Source: own survey of researcher in feb, 2021)

This study is a questionnaire and schedule-based survey of the farmers in the Agra Division. Respondent's farmers lie in the age group of 18-65 years, possessing qualification of High-school and above. A structured questionnaire will be designed for collection of data or by observations of some selected villages, which are selected randomly out of the blocks of Agra division. A total number of 598 questionnaires will be distributed among the staff of KVKS and farmers of rural areas randomly.

DATA COLLECTION

Primary Data: The primary data will be collected through a well-structured questionnaire from the respondents of selected Districts (Agra, Firozabad, Mainpuri and Mathura) of Western UP. The respondents will be farmers and the staff members of KVKs of these selected Districts.

Secondary Data- The secondary data will be collected from:

1.Ministry of Information and Broadcasting

2. Government of India Ministry of Agriculture

3.Newspapers: Economics Times, Hindustan times etc.

4.Different researches, published research papers, Thesis, Journals, Articles, etc.

5.Related websites: www.indiaagronet.com , www.agriculture.up.nic.in , www.farmech.dac.gov.in , www.icar.org.in , www.agra.kvk4.in , www.firozabad.kvk4.in , www.mainpuri.kvk4.in, www.mathura.kvk4.in, etc.

- **SPECIFIC RESEARCH METHODOLOGY**

To accomplish objectives of the study the researcher will use the following specific Research Methodology mentioned below in tabular form.

TABLE-10 SPECIFIC RESEARCH METHODOLOGY

S. No.	Objectives	Sources	Data Analysis
1.	To get an overview of the role of ICT services in Agriculture Sector.	Secondary data	Trend Analysis
2.	To determine the awareness level of farmers and its effect on the use of ICT initiatives in the selected area on demographic basis.	Primary data	Chi-Square test and T-test will be used for analysis the demographic profile of the farmers.
3.	To know the impact of ICT services on Agriculture Productivity on major crops of Agra Division.	Primary data	Regression Analysis correlation and regression analysis will be used for achieving this objective.
4.	To construct an action plan based on the use of ICT services in Agriculture and challenges faced by farmers.	Primary data and Secondary data	As per result of the study.

PROPOSED CHAPTER PLAN OF THE STUDY

Chapter-1: Introduction

Chapter-2: Review of Literature & Research framework

Chapter-3: Role of ICT services in Agriculture Productivity

Chapter-4: Data Analysis & Interpretation

Chapter-5: Findings, Conclusion & Suggestions

References & Bibliography

Appendix

References

Madhu Bala (2019). Role of Information, Communication and Technology (ICT) in Rural Development. Paper presented at Rural Development Paradigms and Livelihood Security in India Conference, Maharaja Agrasen Mahavidyalaya, Jagadhri, Haryana (India)

Chitla A. (2012)," Impact of Information and Communication Technology on rural India", IOSR Journal of computer Engineering, vol.3, issue -2, pp 32-35.

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2010, African Journal of Agricultural Research. 5(20): 2747-2756.

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2011, Journal of American Science. 7(3): 520-525

Manzar O. Adversity to Success the World's Best e-content and Creativity Experience. The Country Paper INDIA, Global ICT Summit. Digital Empowerment Foundation, Hong Kong, 2004.

Meera Shaik N, Anita Jhamtani, Rao DUM. Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India, Agricultural Research and Extension Network, Network Paper No. 135, 2004.

Verma, Ravinder Kumar (2017) Sustainability of Digital Intermediaries in Rural Development: A Case Study of E-Gram Vishwa gram Project of Gujarat, India. Available at SSRN: https://ssrn.com/abstract=3058631

LA Akinbile, O. A. (2010). "Use of ICTs among fish farmers in Oyo State." Journal of Agricultural Extension 14(1).

Raja Sahu (2016) The Role of ICT in Governing Sustainable Rural Development in Madhubani District International Journal of Arts, Humanities and Management Studies (IJAHMS) Volume 02, No.05, 1-6

Jayade, K. G., Khot, P. G., Ambani, G (2014). - Study of Information Communication Technology in Agriculture in Vidarbha Region of Maharashtra State of India. International Journal of Software and Web Sciences (IJSWS), 9(2), pp. 115-119.

ABOH, C. L., 2008. Assessment of the frequency of ICT tools usage by Agricultural Extension agents in Imo State, Nigeria, Journal of Agriculture and Social Research, 8 (2).

Ayo, C.K., Adewoye, J.O, and Oni, A.A. (2010), "Business-to-Consumer e-commerce in Nigeria: Prospects and Challenges. African Journal of Business Management, 5(13), pp. 5109 – 511.

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2010, African Journal of Agricultural Research. 5(20): 2747-2756.

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2011, Journal of American Science. 7(3): 520-525.

CBN (2014). Estimated Output of Major Agricultural Commodities. Production Year Book: Central Bank of Nigeria; Federal Ministry of Agriculture and Rural Development and State Ministries of Agriculture and Natural Resources.

Hallova, M., Polakovic, P., Viragh, R. and Slovakova, I. (2017). Information Security and Risk Analysis in Companies of Agriresort. Agris on-line Papers in Economics and Informatics. IX, (1).

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2010, African Journal of Agricultural Research. 5(20): 2747-2756.

F. Lashgarara, S.M Mirdamadi, S.J. Farajallah Hosseini, 2011, Journal of American Science. 7(3): 520-525.

Chavula, K. H., (2013). The role of ICTs in agricultural production in Africa. Journal of Development and Agricultural Economics. 7(7), pp. 279 – 289; DOI: 10.5897/JDAE2013.0517

Tiwari, K. N., & Dubey, D. C. (2017). Impact of information technology in rural development: An analytical study in Allahabad District. *International Journal of Academic Research and Development* , 01-04.

Journals

International Journal of Academic Research and Development

International Journal of Business Policy & Governance

International Journal of Information & Computation Technology

Journal of Computer Science and Technology

Websites

www.agra.nic.in

www.firozabad.nic.in

www.mainpuri.nic.in

www.mathura.nic.in

www.ikisan.com

www.icar.org.in

www.india.agronet.com